Book Review

Modern Raman SpectroscopyA Practical Approach By Ewen Smith (Strathclyde University, Glasgow, U.K.) and Geoffrey Dent (Intertek ASG and UMIST, Manchester, U.K.). John Wiley & Sons, Ltd: Chichester. 2005. xii + 210 pp. $45.00. ISBN 0-471-49794-0.

Patricia Ann Mabrouk

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BOOK REVIEWS

Fullerenes: Chemistry and Reactions. By Andreas Hirsch and Michael Brettreich (Friedrich Alexander University of Erlangen-Nuremberg). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim, Germany. 2005. xviii + 423 pp. $180.00. ISBN 3-527-30820-2.

Research on fullerenes and derivatives of these materials has undergone explosive growth since their discovery in 1985. Fullerenes are now an established class of compounds in organic chemistry. A comprehensive book on the chemistry and reactions of these unique materials is welcome at this stage of development. This work by Hirsch and Breitreich fulfills this need adequately and nicely complements the earlier seminal book by Hirsch entitled *The Chemistry of the Fullerenes*.

The breadth of coverage and concise style of *Fullerenes* give it a unique character. This book and its predecessor are the best monographs in the field. The quality of the book is greatly enhanced by the fact that the authors are excellent practitioners of fullerene chemistry.

Fullerenes is composed of 14 chapters and begins with an exhaustive coverage of the parent fullerenes, including their discovery, synthesis, separation and purification, and physical and spectroscopic properties. Subsequent chapters (2−10) expose the reader to a well-presented review of fullerene reactions. Areas covered include reduction, nucleophilic additions, cycloadditions, hydrogenation, radical additions, transition metal complex formation, oxidation and reactions with electrophiles, halogenation, and the regiochemistry of multiple additions. Chapters 11 and 12 cover cluster-modified fullerenes and heterofullerenes, and the penultimate chapter provides an excellent account of the chemistry of the higher fullerenes that includes 380 references.

In the final chapter, the authors identify and discuss areas of interest for future studies. These include heterofullerenes, cluster-modified fullerenes, structurally defined and isomerically pure single-wall carbon nanotubes (SWNTs) and their derivatives, and the use of fullerenes as building blocks for molecular engineering and practical applications. This chapter also contains relevant references to materials that exhibit remarkable biological properties.

The book is well-structured, easy to read, and contains a vast collection of references. References to work published as recently as 2003 can be found in each chapter. *Fullerenes* is an excellent book for both students and researchers. It is a must for those who plan to enter the field of fullerene chemistry or other areas related to carbon nanomaterials. Those who have participated in this emerging field will find the book thoroughly enjoyable. Reading this comprehensive account of fullerene chemistry was a great pleasure for this reviewer. It is remarkable how one highly readable book so succinctly introduces the reader to this rapidly expanding field.

W. E. Billups, *Rice University*

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Modern Raman Spectroscopy—A Practical Approach. By Ewen Smith (Strathclyde University, Glasgow, U.K.) and Geoffrey Dent (Intertek ASG and UMIST, Manchester, U.K.). John Wiley & Sons, Ltd: Chichester. 2005. xii + 210 pp. $45.00. ISBN 0-471-49794-0.

This book was written, in the words of the authors, with the hope "that those who are just developing or reviving an interest in Raman spectroscopy will very quickly gain a practical understanding from the first two chapters." Unfortunately, it fails to live up to this goal.

In terms of content, this book comprises seven chapters. Chapter 1 is a qualitative discussion of fundamental concepts and a description of the basic Raman experiment. Raman spectroscopy is presented as a qualitative tool for structural analysis. No mention is made of the quantitative capabilities of this technique. The following chapter has a focus on the instrumentation used in the Raman experiment. The basic components of a Raman instrument, including available excitation sources, wavelength selectors, and detectors, are not clearly described. It is unlikely that a novice will come away with any meaningful understanding of the Raman instrument or how the Raman measurement is made. A superficial, choppy introduction to some aspects of the underlying theory, including Hooke's law, polarizability, group theory (although not enough information is provided here to make this presentation meaningful), and the selection rule, is provided in Chapter 3. The resonance effect, a phenomenon unique to Raman that has proven powerful in its application to biomolecules, is finally introduced in the next chapter. Sadly, the applications selected will likely leave the readers unaware of the selectivity and specificity afforded by the resonance effect in biospectroscopy. Surface-enhanced Raman scattering, surface-enhanced resonance Raman, and the principal mechanisms underlying these phenomena—charge transfer and electromagnetic—are introduced in Chapter 5. Chapter 6 presents an eclectic mix of applications derived largely from work done in the 1990s. The book closes with a brief (20-page) chapter on "advanced Raman scattering techniques". Topics in this chapter include fiber optics, tunable lasers, UV excitation, and Raman optical activity.

Overall, the text is poorly written—the language is vague and imprecise. In addition, it contains a significant number of sloppy and troubling mistakes. Consequently, readers are likely to have a difficult time gaining any meaningful, practical understanding of Raman. For example, the authors show the IR and Raman spectra for benzoic acid in one figure. Only one *y*-axis, labeled

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%T, is shown. This is misleading and erroneously suggests to the novice that one records %T in Raman. As another example, the difference in the frequency of the scattered light relative to that of the incident light—not wavelength—is recorded in the Raman experiment. Throughout, the authors use a number of figures reproduced from other sources. Several of these are fuzzy and have been poorly rendered. The symbols and terms shown in many of the figures are presented to the reader without definition or explanation in either the text or the accompanying captions. With the exception of Chapter 6, the focus of which is applications of Raman, the book is poorly referenced, and a number of the references are out-of-date. For example, a second edition of Ferraro and Nakamoto's excellent book on Raman spectroscopy was published in 2003, yet only the original edition, published in 1994, is cited. The text includes a number of URLs for electronic resources, which could have been a plus. Unfortunately, a number of the links are out-of-date or contain typos that render them useless.

For the reasons discussed above, I am uncomfortable recommending this book as an introduction to newcomers in this field. Those who would like a solid introduction to Raman (clarity of expression, depth, rigor) will want to look elsewhere; *Introductory Raman Spectroscopy*, 2nd ed., by Ferraro, Nakamoto, and Brown (Academic Press: San Diego, CA, 2003) would be an excellent choice.

Patricia Ann Mabrouk, *Northeastern University*

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Electronic and Photoelectron Spectroscopy: Fundamentals and Case Studies. By Andrew M. Ellis (University of Leicester, U.K.), Miklos Feher (Neurocrine Biosciences, San Diego, CA), and Timothy G. Wright (University of Nottingham, U.K.). Cambridge University Press: Cambridge. 2005. xiv + 286 pp. $55.00. ISBN 0-521-81737-4.

The young student of physical chemistry, learning the fundamentals of electronic spectroscopy for the first time, will likely be encouraged by his or her instructor to explore the literature for inspiring readings on this topic. However, the basics of absorption and emission barely prepare the student to delve into some of the more sophisticated and clever applications of electronic spectroscopy that are commonplace in the literature. This text bridges the gap between the basics and cutting edge applications of electronic spectroscopy at a level appropriate for upper-level undergraduates and junior graduate students.

This is a well-organized book, with three main sections devoted to basic principles, experimental techniques and considerations, and an array of "case studies". A fairly extensive set of appendices rounds out the text. The first section on the fundamentals of spectroscopy provides an overview of atomic and molecular electronic structure, the various manifestations of angular momentum, vibrations, and electronic transition moments. These first seven chapters are very brief and easy to read, although at the expense of the rigor that may be appreciated by the more sophisticated student.

The second section gives simple descriptions of a number of tools commonly encountered in spectroscopic experiments, including supersonic jets and lasers. There is also an introduction to a menu of techniques in the two chapters "Optical spectroscopy" and "Photoelectron spectroscopy". These descriptions are very short and have very few references associated with each technique. Moreover, in some cases, very important developers of certain techniques are excluded from the list of references. Six techniques are listed in each chapter, several of which are cavity ringdown spectroscopy, double-resonance techniques, Penning ionization, and ZEKE-PFI, although no mention of anion ZEKE is made, and neutral ZEKE and ZEKE-PFI are introduced as unambiguously distinct techniques.

The last and largest section has 16 chapters, each of which has a detailed description of the application of one of the aforementioned techniques to a molecule or small set of molecules. Each chapter begins with a summary of the concepts that are reinforced by the case study. The various studies are fairly self-contained—sometimes based on a single experimental study, sometimes drawing from the results of multiple independent studies. The studies start off with historical work on the ultraviolet photoelectron spectrum of CO (1970s) and run through more recent work (1990s) on cavity ringdown spectroscopy of O_2. The level at which the various systems are analyzed is comfortably consistent with the authors' target audience.

Included in the appendices are a summary of spectroscopic units and a brief overview of electronic structure calculations, including a list of several software packages and the molecular properties these packages typically calculate. Appendices on angular momentum with spin−orbit coupling, group theory, electronic configuration, and simulations on rovibronic structure are also included.

Overall, the text was clearly written and easily digested. It would be an appropriate supplemental textbook for an upper-level undergraduate spectroscopy or quantum mechanics course or for nonphysical graduate students who wish to increase their familiarity with the important spectroscopic tools they may encounter.

Caroline Chick Jarrold, *Indiana University*

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Name Reactions and Reagents in Organic Synthesis, 2nd ed. By Bradford P. Mundy (Colby College, Waterville, ME), Michael G. Ellerd (Maxim Technologies, Bozeman, MT), and Frank G. Favaloro, Jr. (Helicon Therapeutics, Farmingdale, NY). John Wiley & Sons, Inc.: Hoboken, NJ. 2005. xvi + 882 pp. $89.95. ISBN 0-471-22854-0.

This book is what the title suggests: a compilation of commonly used and widely known name reactions and reagents in modern organic synthesis. This edition includes many modern name reactions and eliminates those that have little contemporary use. The "rule of thumb" used by the authors was that "a newer name had to be cited by multiple authors." Reactions are presented alphabetically and include proposed mechanisms, notes about the reaction and references, and examples. References are to the primary literature and, where appropriate, to

secondary sources for further details. A subject index completes the book.

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Named Organic Reactions, 2nd ed. By Thomas Laue and Andreas Plagens (Volkswagen AG, Wolfsburg, Germany). John Wiley & Sons, Ltd: Chichester, U.K. 2005. x + 310 pp. $55.00. ISBN 0-470-01041-X.

This reference presents descriptions of approximately 135 reactions in organic chemistry based on "their importance for modern preparative organic chemistry", to quote from the preface. The reactions are arranged in alphabetical order, and each entry gives a one-sentence summary of the reaction, a chemical equation for it, an introduction to the reaction, a description of its mechanisms, and a list of references to the primary literature as well as to recent publications. This new edition includes some new reactions, such as the Baylis−Hillman reaction, as well as new developments to previously listed reactions. A short subject index completes the book.

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Electrochemical Aspects of Ionic Liquids. Edited by Hiroyuki Ohno (Tokyo University of Agriculture and Technology). John Wiley & Sons, Inc.: Hoboken, NJ. 2005. xiii + 392 pp. $150.00. ISBN 0-471-64851-5.

This book highlights recent developments in the study of ionic liquids (ILs), with an emphasis toward a broad range of electrochemical applications. Its 32 chapters encompass research from both fundamental and more applied perspectives, and the references contained therein are as recent as 2004, with an emphasis on research performed in the past 10 years. The chapters are organized into seven different sections based on the topics covered. Indexing is well done throughout.

The first section presents an overview of the physicochemical properties of room temperature ILs relevant to electrochemical study and catalogs useful information on appropriate reference electrodes, electrochemically stable potential windows, and ionic conductivities of several organic and inorganic ILs. Also included are recent examples of electrosynthetic applications using ILs, including electropolymerization and metal depositions. In particular, the information contained within this section is useful for those already working in electrochemical applications but unfamiliar with the use of ILs as solvent systems.

The second section highlights recent developments using ILs in biochemical analyses, covering topics on lipid formation/structure as well as discussions on enzymatic reactions and redox-active proteins. While the information presented is by no means complete and does not directly involve electrochemical aspects, it does illustrate current progress in the field and highlight future areas of study.

The third section covers the application of ILs related to energy storage and conversion such as batteries, fuel cells, solar cells, and supercapacitor technologies. Relevant principles and problem areas for each technology are identified, but only briefly discussed. Abundant examples of device testing are presented, emphasizing the advantages and disadvantages of ILs utilized in the respective technologies. Regrettably, some chapters in this section, such as the one on fuel cells, present very little data and consist of nothing more than a few preliminary studies.

Sections four through seven of the book detail various and somewhat disjointed applications of ILs, including magnetic ionic liquids, ionic liquid gels, liquid crystalline materials, polymer gels, DNA-based gels, and polymer brushes. Of these, the fourth section is perhaps the most beneficial because a plethora of data on fluorinated, amine-based, zwitterionic, alkali metal-containing, polyether-derived, and electron-radica-possessing ionic liquids is discussed. This section also includes ample reference data of physicochemical properties, e.g., ionic conductivities and melting points, for these systems.

As a whole, this book attempts to cover new developments in ionic liquids in a comprehensive fashion. Unfortunately, several chapters do not complement each other well and seem awkwardly arranged and out of place. Additionally, the terminology and symbols used between chapters is not consistent, which significantly detracts from the quality of presentation. Many of the chapters read much like papers from conference proceedings, and some chapters focus almost exclusively on work from an individual laboratory. Although this is partially unavoidable due to the novel nature of some of the topics, further editing and organization would have provided a stronger impact. Suffice it to say that the quality of the text is uneven.

In summary, this book surveys a broad array of topics that newcomers to ionic liquids will find beneficial. More experienced researchers in the field of ionic liquids, especially those well-versed in the electrochemical aspects, will find it only moderately helpful as a supplement to existing monographs on ILs.

Keith J. Stevenson, *University of Texas at Austin*

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